

PROBLEMS OF FISHERIES DEVELOPMENT IN CEYLON¹

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Very few countries have had the benefit of advice from so many specialists in planning the development of their fisheries as Ceylon. In recent years, Dr. C. F. Hickling, Colonial Fisheries Adviser, the late Dr. H. Blegvad, Director of the Danish Biological Station and General Secretary of the International Council for the Exploration of Seas, Dr. Ettrup Peterson with his collaborators, Dr. C. C. John, Director of Research and Professor of Marine Biology and Fisheries, Travancore University (now Deputy Director of Fisheries, Ceylon) and Dr. G. L. Kesteven, Regional Fisheries Officer for Asia and the Far East, surveyed the fishery resources of Ceylon and made recommendations for fisheries development and research in the island. Their reports have been published in the form of a Sessional Paper² by the Government of Ceylon. Copies of this publication were sent to several experts to elicit their views and some very useful comments have been received from Dr. W. C. Neville, Chief, Fisheries Division (Natural Resources Section), G.H.Q., SCAP, Tokyo, Dr. R. Van Cleve, Director, School of Fisheries, Washington and Dr. A. W. C. T. Herre, School of Fisheries, Washington. Mr. W. H. Schuster, Chairman of the Committee of Fish Culture, Indo-Pacific Fisheries Council and now Fishery Biologist, F.A.O., Rome, has made a special survey of the Inland Fisheries of Ceylon and his report has been published separately as another Sessional Paper.³ Mr. I. S. R. Munro, Senior Research Officer, Fisheries Research Station of the Australian Commonwealth Council for Scientific and Industrial Research, Cronulla, worked in the Department of Fisheries, Ceylon, for about 3 months organising a programme of inshore marine research. This report has been published as an appendix to the Administration Report of the Acting Director of Fisheries for 1951 (Government Publications Bureau, Colombo, 1952). In effect these publications and the comments of experts together form a Symposium on Ceylon fisheries and lack only a summing up and a final analysis of the opinions of these experts.

¹ This note was prepared, when one of us was offered the post of Director of Fisheries, Ceylon, in 1951. It is now published in the hope that it may prove of some use to others interested in the development of fisheries of this Island.

² *Ceylon Fisheries*.—Recommendations of Experts on Fisheries Development, Research, Socio-economic and Industrial Problems. Sessional Paper VI—1951, Ceylon Government Press, Colombo. Price: Rs. 3.85, postage: 30 Cents (To be purchased from the Government Publications Bureau, Colombo).

³ *Report on a Survey of the Inland Fisheries of Ceylon*.—Sessional Paper XXIV—1951, Ceylon Government Press, Colombo. Price: 40 Cents, postage: 10 Cents. (To be purchased from the Government Publications Bureau, Colombo.)

FISHERY RESOURCES OF CEYLON

The fisheries of Ceylon can be classified into five distinct ecological units, viz., (1) Cold water fisheries in the hills, (2) Fluvial and lacustrine fisheries of the plains, (3) Fisheries of the brackishwater lagoons, swamps and other tidal areas, (4) Inshore marine fisheries, and (5) Offshore marine fisheries. A brief assessment of these fisheries is given below *seriatim*.

Cold Water Fisheries in the Hills.—Apparently the hillstream fisheries have been considered to be the least important and this region has not received much attention from the experts. The upland waters of Ceylon have imported Trout and European Carp in them, besides the indigenous fishes. Apart from providing sport to anglers, the hillstreams and other water areas in the region could possibly contribute to the supply of acceptable varieties of fresh fish for local consumption. *Barbus (Tor) khudree* is known to occur in Ceylon waters and is a good sporting fish. More systematic work should be undertaken on the cultural possibilities of this fish. The possibility of expanding the culture of European Carp and Tench also needs investigation. Though there is reported to be a decided prejudice to fresh water fish in the Island,¹ the residents of hill stations will, in all probability, prefer fresh freshwater fish to unhygienically prepared dry saltwater fish, if attempts to popularise this are backed by adequate propaganda. Under very similar conditions, the culture of Mirror Carp and Tench has become a great success in the Nilgiris (India). Mr. Schuster recommends an association of Gouramy, *Helostoma* and *Etroplus*, for tanks which retain water for long periods. Mr. de Zylva informs us that the experiments initiated by the Department have shown that the Gouramy can thrive in the upland waters at about 4,500 ft. even though they did not survive at a height of about 6,000 ft. *Etroplus* is not generally believed to be suitable for such waters; and for any large-scale culture programmes it might be more advisable to concentrate on proved varieties such as the Common Carp. Estimates of areas suitable for culture and quantities likely to be consumed locally will have to be made before starting this venture.

Fluvial and Lacustrine Fisheries of the Plains.—The fisheries of rivers, tanks and lakes form a comparatively neglected zone of fishery resources in the country. There are several seasonal irrigation tanks, freshwater lagoons as well as large perennial irrigation reservoirs of an estimated extent of about 10,000 acres abundant in fish fauna. According to Dr. Kesteven, the lakes and tanks contain Gourami, Catfishes, Murrel, Pearlsplit, *Wallago*, *Anabas* and *Labeo*; and the rivers have Mahseer, Murrel, Pearlsplit, Gourami, Catfish, *Wallago*, etc. Mr. Schuster observes that there is a preponderance of predaceous species indicating that nature took its unhindered course in these waters and the predaceous species 'have generally occupied such a prominent position that no other species can subsist in their presence in any worthwhile numbers, while the stock of the vegetable feeding fishes has dimi-

¹ Mr. R. de Zylva, the Ag. Director of Fisheries, Ceylon, in a private communication informs us that 'it is only the urban population that is fighting shy of buying freshwater fish, but these fishes are very popular in the villages'.

nished so much that only a small part of the food resources is actually converted into fish meat'. Predaceous species are generally of good flavour and taste and species of murrels and spiny-eels are greatly relished in India. It may be desirable, therefore to start long-lining for these fishes. It is obviously essential to control the number of predatory fishes, but there appears to be religious and other objections to fishing in many of these waters during the dry season and the catches are estimated to be about 300 tons which are chiefly dry-salted, or smoked. According to the experts, no freshwater fish is very welcome to the fish-eaters of Ceylon, except the Gourami which is bought in the belief that it is a saltwater fish. A judicious management programme to restore the equilibrium between herbivorous and carnivorous species is the primary need. The stock of herbivores, such as Gourami, and the Pearlsport can be substantially increased by both lake and river improvement methods as well as cultural operations. A good beginning has already been made by the Department of Fisheries in the stocking of inland waters with Gourami fry.¹ In view of the paucity of suitable plankton feeding fishes, the possibility of introducing exotic plankton feeders such as *Tilapia mossambica*, *Trichogaster pectoralis* and *Helostoma temmincki* will have to be explored. Experiments in the breeding of *T. mossambica* are reported to have been successfully conducted and according to the latest Administration Report of the Department, no further imports of this fish will be necessary as the fish propagates very rapidly.

Brackish Water Fisheries.—The coast of Ceylon abounds in salt water lagoons affording lucrative fisheries and its rich estuarine waters have an estimated extent of 300,000 acres. The important catches consist of Mulletts, Rays, Garfish, Cock-up, Prawns and not rarely Milk fish. A few thousand men are engaged in fishing in these areas and they use stake nets, traps, cast nets and brush wood and other types of lures. This part of the industry is owner-operated and according to Dr. Kesteven the production is estimated at a few hundred tons per year.

Because of the coastal erosion in Ceylon waters, the sedimented debris deposited by the rivers constitute the main source of fertility of the estuarine waters. The better productivity of areas like Lake Negumbo compared to those like Lake Chilaw is obviously due to the rich deposits of soft mire.

Mulletts, prawns and milk fish are well favoured items in the markets and most of the specialists are of the opinion that there is very good scope for developing their farming in this region. A thorough biological survey of the localities that are likely to be suitable for opening farms and the determination of their productivity, the seasons and places of availability of fry, etc., will have to be made initially before starting large-scale farming programmes.

All the economically important fishes and crustaceans of the estuaries, except *Etroplus suratensis*, are inshore breeders and their fry enter estuaries and backwaters. The sand bars formed in front

¹ Administration Report of the Acting Director of Fisheries for the years 1940-50, Part I—1940-47 by E. R. A. de Zylva, 1951, Ceylon Government Press, Colombo.

of the estuaries are considered to be obstacles in the way of a continuous supply of fish and prawn seed to these brackish water areas. Provision to ensure such a supply by breaking up the sand bars wherever necessary appears promising. Mr. Schuster also recommends the stocking of brackish waters with fry of *Chanos* reared in nursery ponds. Mr. de Zylva informs us that a start has already been made by the Department of Fisheries in this direction.

Inshore Fisheries.—The inshore fisheries of Ceylon are of the maximum importance and represent approximately 90% of the total fishery resources. Nearly 40,000 men employing about 6,000 catamarans and 4,350 outrigger canoes fish in the inshore waters with about 3,500 seine nets and 5,400 drift nets. They are responsible for the supply of about 30,000 tons of fish annually. The beach seines make heavy catches of *Dussumeria*, *Sardinella*, Anchovies, *Hilsa*, *Chirocentrus*, *Ilisha*, Pomfrets, Horse Mackerels, Sciaenids, Dog fishes, Rays, *Chorinemus*, Mulletts, *Sillago*, *Arius* and Prawns. Hand-lines operated from the outrigger canoes or 'orus' catch chiefly Kingfish, Tunnies, Barracoutas, *Chorinemus*, *Lutianus* and *Epinephelus*. The large-meshed gill nets are employed for catching sharks and other large fish such as *Polynemus*; and the small-meshed ones for *Chorinemus*, *Arius*, *Triacanthus*, *Platycephalus*, *Belone*, Mulletts, small Sparids, *Sardinella* and small Flat-fish. Hand trawls or open water seines catch small fish such as *Sillago*, *Sardinella*, Sciaenids, small Scads, small Barracouta, Mene and Prawns. The pearl oyster beds also fall within this ecological region. The fishermen are mere wage earners in this region and the industry is operated by the middlemen who own the gear.

There appears to be some difference of opinion among the experts regarding the present position of the inshore fishery. While Dr. John believes that the production from this region can easily be doubled to meet the fish shortage, Dr. Kesteven finds reasons to believe that 'the industry is virtually saturated and may in some instances be in, or approaching, a depletionary condition'.¹ He therefore recommends the diversion of inshore fishermen to brackish and offshore sections. If Dr. Kesteven's surmise is correct, very great care has to be taken in introducing the various effective modern gears recommended. It will be advisable to make a thorough biological and statistical study of the fish stocks before either intensifying the exploitation of the

¹ Dr. John has further commented on this point as follows: 'One of the advantages of the geographical position of Ceylon is the fact that most of the migratory shoals of fishes, which move shorewards from the Indian Ocean, first touch the continental shelf of Ceylon and subsequently pass on northwards to the east or west coast of India. The Tunnies, Mackerel, Butter fish, Anchovy and Ribbon fish are some of the outstanding instances. In the case of such migratory fishes it will be somewhat hasty to conclude that with the simple methods of fishing practised in this country, the industry has reached a saturation point, or that inshore fisheries have begun to show signs of depletion. The inadmissibility of this observation can be proved by the fact that the neighbouring country of Travancore, which has only a coast line of 172 miles, exports annually about 300,000 cwt. of dry fish after meeting her domestic requirements. This is all the more significant when it is remembered that some of the shoal fishes reach the coast of Travancore only some weeks after they first appear on the Ceylon coast. If signs of depletion are noticeable in Ceylon, naturally its consequences will be felt in Travancore also. But this does not seem to be the case.'

inshore fisheries or taking any steps to decrease the fishing effort in these waters.

The handling and distribution of fish is in a very unsatisfactory condition and calls for great improvement. Due to the ill-organised state of the industry, the price of fish is too high and the fish available in the markets is not quite wholesome. As Dr. John puts it: 'if the fishing industry is to be improved and the markets are to be supplied with fresh and wholesome fish it is very essential that the system of packing, preservation and transport should be completely reorganised on modern lines'.

The continental shelf of Ceylon is a very narrow strip running parallel to the coast, the width of it being only about 6 to 18 miles in the southern half of the island. The northern half, however, is wider and the widest region is between Mannar and Jaffna. The scope for extensive offshore fishing is naturally limited to the northern part of Ceylon and the Wadge and Pedro banks. Even these banks are not more than 30-45 miles wide. Further, even though there are trawlable areas, the greater part is reported to be rough and uneven, which make trawling difficult. The industry in this section at present consists of trolling operations for sail fish, tuna, spear fish and mackerel; and hand-lining for reef fishes. There is also some jigging for tuna and some use of special 'grab all' gear for tuna and other midwater fishes. In this section of the industry, ownership is somewhat complicated; the fishermen always own the gear but frequently do not own the boats. Besides the local crafts, there are two steam trawlers working from Colombo, *viz.*, an Italian trawler owned by a Colombo businessman and the Ceylon Government trawler 'Raglan Castle'. There are no detailed records available regarding the production of fish from this region. According to the Administration Report of the Department of Fisheries for 1940-47, 6,392 cwt. and 4,175 cwt. of fish were landed by 'Raglan Castle' in 1945-46 and 1946-47 respectively. Unfortunately the landings of the Italian trawler have not been studied by any of the experts during the surveys. Dr. Hickling computes the rate of fishing of the Government trawler to be about a ton of marketable fish per haul, or five tons per day, or 387 cwt. per 100 hours of fishing. A new oil-fired trawler 'Braconglen' bought by the Department recently has commenced fishing from July 1951. She did 12 trips during the year and spent 91 days at sea and landed 4,778½ cwt. of fish, thus giving an average catch of 389 cwt. per trip. There are, however, no detailed records of the nature of the bottom or the extent of the fishing grounds of this region.

PROBLEMS OF FISHERY DEVELOPMENT AND THEIR SOLUTION

An analysis of the data contained in the reports, indicates that the outstanding problems of fishery development in Ceylon are the following:—

1. How can an immediate improvement be effected in the price level and availability of fish in Ceylon?
2. How can freshwater fish be made popular among the urban populations?
3. Can brackish water fish farming be developed in the country?

4. Can freshwater fish culture be developed on a large scale?
5. Is diversion of the inshore fishermen to inland and offshore fisheries advisable?
6. Will it be advisable to start large-scale deep-sea fishing in Ceylon at present?
7. Is mechanisation of fishing desirable at this stage?
8. What type of Governmental aid should be given to the operatives to improve the industry?
9. What is the nature of research that should be undertaken by the Fisheries Department immediately?

The solutions to these problems that suggest themselves as practicable under the conditions described in the reports are discussed briefly below.

1. Dr. Peterson has found that the Colombo fish market dominates the fish trade and prices of fish, and a balance wheel put on the market here will adjust the fluctuations all over the island. This control may have to be exercised in two ways. One is by increasing the supplies of fish to Colombo markets and by the introduction of proper preservation (freezing, icing and curing), transport and hygienic handling of fish so that the product will reach the consumer in a wholesome condition. The other is by fixing the ceiling price of fish and fish products for sale and organising a machinery to exercise that control.

The total annual consumption of fish in Ceylon is estimated by Dr. John to be approximately 64,600 tons including local production and imports and if her requirements, estimated at a *per capita* consumption of 35 lb. of fish per head for its population of about 7,000,000 people, should be met without depending on imports from foreign countries, her production will have to be increased approximately by 71,000 tons. The major problem is, which source can effectively meet this requirement. The inshore fishery is reported to show signs of depletion and only restricted quantities can be expected from the offshore fishing grounds. So an appreciable increase in fish supplies may not be possible from these regions immediately. The solution therefore appears to be the development of the inland fishery resources.

2. Freshwater fish is believed to have a muddy flavour and is therefore not favoured by at least the urban population. Such prejudices have existed in almost every country in respect of certain articles of diet, but in times of emergency it has been possible to overcome these to a considerable extent by propaganda. As Dr. A. W. C. T. Herre has commented on this point, 'in no country are there enough first class fish to feed all the people'. It is therefore very important that the less favoured types of fishes also should be properly utilized to meet the fish shortage. The U.S. Fish and Wild Life Service is reported to have popularised the use of several types of fishes by evolving special recipes for cooking them and demonstrating these improved methods of cooking to the public. The Chinese practice of hospitalising fish before sale may help in removing any objectionable flavour from fish flesh. Another possible means of approach is the brine-curing of freshwater fish, which may render it acceptable to the consumers. The Madras Fisheries Department has popularized

the Mettur Reservoir fish in this way and have thereby been able to develop the fishery of the reservoir considerably. The lines followed by the Coffee Houses, the Wheat Houses and more recently the Non-cereal Cafeterias in India to popularise unfamiliar food products, may be worthy of emulation in Ceylon.

3. Dr. Hickling and Dr. Kesteven have in their reports recommended the opening of brackish water fish farms in Ceylon. Mr. Schuster, who has made a special study of the inland fishery conditions, is of the opinion that developmental work in these waters should wait till a limnological survey of the backwaters is made to obtain the necessary basic data. According to him, fertile mud as required for pond construction is scarce and the necessary minimum tidal range of five feet is not to be found in any part of Ceylon. These facts preclude a large-scale construction of ponds. However, the economics of pond construction in these areas under the conditions prevailing in the Island will have to be more intensively investigated. As his report indicates, there exist several fertile tracts where construction of ponds does not entail much expenditure and which can immediately be converted into farms. Suitable large-scale experiments in the cultivation of mullets, prawns and milk fish should be initiated along with an intensive biological investigation of typical brackish water lagoons. On the basis of the results obtained from this work, the programme of farming in these areas has to be formulated.

Mr. Schuster advocates a policy of stocking estuarine waters with plankton feeding fishes. *Trichogaster pectoralis* may be a suitable species for a low salinity. An appropriate plankton feeder for propagation in waters of higher salinities has yet to be found. He also recommends the stocking of the brackish waters with *Chanos* fry reared in special nurseries. Though it is rather difficult to forecast from the experiments already undertaken by the Fisheries Department whether these operations will be economically worthwhile, proper provision of connection of these waters with the sea, probably will equally serve the purpose at a lower cost.

4. It has already been seen that the development of inland fisheries will go a long way to solve the fish shortage. All available data tend to show that next to brackish water fish farming, freshwater pond culture ranks as a very promising source of fish supplies. A large number of ponds and reservoirs could be found where religious or other prejudices will not hamper fish culture operations. To begin with, the culture of Gourami can be started in the plains and the European Carp in the upland waters. When propaganda has succeeded in making freshwater fishes popular or at least acceptable, the cultivation of other quick growing varieties can be considered. In Singapore, Chinese fish culturists import fry from China and there seems no reason why Ceylon cannot get its supply of suitable species from India or China or from both. The Administration report of the Department for 1940-50 shows that a start has already been made in this direction.

5. There does not seem to be sufficient evidence to say conclusively that the inshore fisheries are on the verge of depletion. Considering the great efforts the Government will have to make to divert the fishermen to inland areas, it may be premature to plan this till detailed

investigations are made to assess the position of the fish stocks in the region. However, if signs of depletion are really found, it will be essential to decrease the fishing effort, and for that purpose divert some of the fishermen to inland and offshore waters. In view of the limitations of the type of deep-sea fishing operations that can be undertaken by the local fishermen, the brackish water areas seem to be the proper region to absorb them. More intensive lagoon fishing, where feasible, and fish farming will engage them and offer them attractive returns.

6. As already indicated, there is not much reliable data on the extent and nature of the offshore fishing grounds and very little is known of the fish stocks. In Dr. John's opinion Ceylon's offshore fishing grounds will not be able to feed more than three trawlers. It is doubtful whether a regular deep-sea fishing industry could be built up on the limited information available regarding the fishing grounds and the fish stocks. So the Ceylon Government should try to work at present a couple of medium-sized vessels, with the co-operation of India, if possible, to gather sufficient information in order to assess the possibility of undertaking commercial deep-sea fishing in these waters.

Comparatively better fishing returns of the Japanese trawler working along the Bombay coast suggests that Japanese methods of fishing may prove more fruitful for Ceylon waters also. The advisability of using Japanese craft and gear needs careful consideration.

7. The mechanisation of fishing craft and tackle mainly aims at increased production. This has been recommended by experts to improve fishing in the inshore waters. But if Dr. Kesteven's observation that the stocks in this region are on the verge of depletion is correct, the question of increased production from this region will not arise. Moreover, some of the crafts like the Outrigger Canoe and Catamaran do not in the opinion of experts, need any further improvement and are well suited for the conditions under which they have to operate. It will, however, be desirable to popularise the 'moored vessel fishing' so that the fishermen's catches can be preserved properly and brought to the markets in good condition. Very encouraging results have already been obtained by the Fisheries Department in this direction by employing the seiner 'Halpa', the M.F.V. 'Seer' and the Patrol launch 'Kunissa' for towing boats to fishing grounds and back¹. Even though it may not be advisable to make any great alterations in the craft and tackle to enhance their efficiency, efforts to simplify their operation can be made even at this stage.

8. The fishery operatives form the backbone of the industry and their social advancement is essential to the development of the industry. As Dr. John points out, administrators have always been thinking in terms of the fishermen only and the others in the industry have been left out from Governmental patronage. For a long time to come, the operatives, other than the fishermen, will also have to remain at their jobs and so they have also to be given adequate Governmental assistance. As this section of the operatives are gene-

¹ Administration Report of the Acting Director of Fisheries for the years 1940 to 1950. Part II 1948 to 1950 and for 1951. Government Publications Bureau, Ceylon, 1952.

rally more educated, it might be possible to form co-operatives to conduct their business in a proper manner, and through such institutions it will be easier for the Government to exercise some control over the fishing industry. The possibilities of development on these lines have been well demonstrated by the working of the Bungalow Delivery Scheme and sale of fish in Departmental Stalls by the Fish Distribution Union in 1946.

Though fishermen's co-operatives will be ideal organisations through which all socio-economic work among the fishermen could be undertaken, experience in India shows that in the present social conditions of the fishermen, co-operative movement alone is not likely to achieve the desired results. It appears that individuals will have to reach a certain stage of social development before they can take kindly to co-operative enterprises. With the ultimate aim of forming co-operative organisations, deserving individuals should be helped; and they would serve as examples to their fellow men. Dr. Blevgad has pronounced himself to be in favour of such a policy. It will be necessary to impart education with a definite fishery bias to the fisher-children, and the fisher boys should be taught improved methods of fishing and handling of fish.

9. Some amount of work on the fishes that are found in Ceylon waters has been done in adjacent countries and much work is now in progress. Ceylon can benefit by this knowledge without spending any money or effort for the purpose. The important research programmes to be undertaken by the fishery department in Ceylon should be ecological surveys to confirm the biology of the fishes in Ceylon waters, population studies to determine the extent and nature of the fish stocks, the effect of fishing on these stocks, and experiments in fish culture. Mr. Schuster recommends a biological survey of a typical brackish water area such as the Negumbo Lake to estimate the productivity of the lagoons. As regards the offshore fisheries Mr. Munro recommends investigations of the seasonal distribution, abundance and movements of the Scombroids, Clupeoids and Carangids and the interpretations of the fundamental biology of the key species. Exploratory work in offshore waters has already been referred to. These are the items of research the department should take up immediately with the help of its own staff. Further studies on the biology of Ceylon fishes can better be done by a team of research associates or students who could be given facilities to work under the Director and the Senior Officers of the department for research degrees of the Ceylon University. A large number of local students will thus get the necessary training to undertake fishery work in the country without the Government spending much money for the purpose. At the same time a good lot of basic information on the biology of the local fishes would have been collected.

To sum up, the immediate means of meeting the fish shortage in Ceylon appears to be the development of brackish water and fresh-water resources by more intensive exploitation and starting of fish farming; and the exercise of control over the preservation and marketing of fish and fish products. Adequate Governmental help is necessary for the advancement of the economic condition of the fishery operatives. The formulation of any definite plan for the improvement of the inshore fisheries may have to wait till the necessary

information has been collected regarding the condition and nature of the fish stocks. Before starting offshore or deep-sea fishing operations on a commercial scale, preliminary exploratory work will have to be done with a view to collect sufficient data regarding the fishing grounds and the fish stocks. Blind following of the western methods of fishing such as trawling are not likely to benefit the nation much, except that it will show us again, as it has done in the past, what should be avoided. Dr. R. Van Cleve, Director of the School of Fisheries, University of Washington, has rightly pointed out in this connection, that in the development of the fisheries in any country the principle to be followed should be that of adopting new developments to the level at which they can be absorbed into the economy of the country concerned, permitting such developments to proceed in a manner that will result in the growth of the native fisheries rather than the development of a foreign fishery at the expense of the natives.